FUTURE SHOCK:
A CASE FOR THE B-2 BOMBER

BY

MAJOR PAUL H. DI JULIO

A THESIS PRESENTED TO THE FACULTY OF

THE SCHOOL OF ADVANCED AIRPOWER STUDIES

FOR COMPLETION OF GRADUATION REQUIREMENTS

SCHOOL OF ADVANCED AIRPOWER STUDIES

AIR UNIVERSITY

MAXWELL AIR FORCE BASE, ALABAMA

JUNE 1994

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
JUN 1994	**N/A**	**-**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Future Shock: A Case For The B-2 Bomber	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Air University Press Maxwell AFB, AL 36112-6615**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**UU**	**52**	

Disclaimer

This publication was produced in the Department of Defense School environment in the interest of academic freedom and the advancement of national defense-related concepts. The views expressed in this publication are those of the author and do not reflect the official policy or position of the Department of Defense or the United States Government.

This publication has been reviewed by security and policy authorities and is cleared for public releases.

CONTENTS

CHART

Abstract

The purpose of this thesis is to stimulate thought on what forces the United States should procure in the future in light of current and projected political and economic climates. In this spirit, different types of conventional forces are compared using the cost of a Naval Carrier Battle Group as the point of departure. The forces are then placed in a hypothetical scenario meeting the criteria of a Major Regional Contingency, in an effort to determine which weapon system is the most cost effective in terms of cost to deliver a weapon. The combat effectiveness of each weapon system is also determined in terms of the time it takes to destroy an armored division, and finally, the time it would take each weapon system to render typical enemy forces combat ineffective.

The weapons systems compared are Naval Carrier Air using a mixture of the A/F-X and the F/A-18, Air Force "tactical" air using the F-117 stealth fighter, and Air Force "strategic" air using the B-2 stealth bomber. While it is a comparative study of sorts, it is not meant to be interpreted that the B-2 is "the only game in town." It is the opinion of the author, that nothing is further from the truth, as each weapon system contributes crucial pieces to the total U.S. air power picture. In the same vein however, the bottom line is that the B-2 is the most cost effective and combat effective in this scenario where the capability to project air power long-range, quickly and in mass, is vital.

Finally, the conclusion of this study is that the weapon of choice to lead American Air Power into the 21st Century, is the B-2. It is the B-2 that is ideally suited for halting an enemy's front line invasion force, or attack targets that are long-range and require quick reactions in mass. The B-2 is the only weapon system capable of projecting air power world-wide at a moment's notice. When considering the future force structure of

the U.S. Air Force, a robust B-2 force of at least 40 available aircraft is essential if the United States continues to desire long-range, rapid power projection. When one considers the cost effectiveness of the B-2 in terms of the cost per weapon delivered, the B-2 is the best choice for the future.

This paper also looks at the types of munitions that are currently available and those that are projected to be available by the year 2000. These weapons are applied to each weapon system equally and analyzed in terms of the time it takes each to halt an invasion force.

With a robust B-2 force, and the right mix of weapons, the "future shock" potential it can deliver to any adversary, anywhere in the world, at any time, makes it the ideal weapon to become the "pointy end of the spear" for the new Air Force.

About the Author

Major Paul H. Di Julio, a B-52 pilot who earned his B.S. degree from the University of New Haven, and his M.A.S. degree from Embry Riddle Aeronautical University, is a recent graduate of the School of Advanced Airpower Studies. He was subsequently assigned to the Checkmate division at HQUSAF/XO, at the Pentagon. He is also a graduate of Air Command and Staff College, and Squadron Officer School. He was previously assigned to Castle Air Force Base where he served as the Chief Bomber Pilot of the Central Flight Instructor School, Flight Examiner, and Instructor Pilot.

He was also assigned to Griffiss Air Force Base where he served as a B-52 Training Flight Instructor Pilot, Flight Commander, and Flight Examiner.

Chapter 1

Introduction

Even as the danger of global war recedes, the potential for smaller but still highly destructive conflicts between nations and within nations is growing. We simply do not and cannot know all the challenges that will arise in the future. What we do know is that our citizens and our interests will be challenged again. We must remain strong enough to protect and defend them.[1] George Bush, former President of the United States

After decades of fighting the Cold War, only one superpower emerged intact from the battle---the USA. As we reflect upon our great victory, and begin to immerse ourselves in the task of cutting back the very forces that led us to victory, we must never forget that as victors, we are looked upon as the protector of democracy. Like it or not, other nations look up to the United States of America as the consummate superpower. The United States alone is viewed by many as the only nation able to preserve world peace. Jonathan Pollack, Corporate Research Manager, International Policy Department, RAND Corporation believes that, "Indeed, America alone seems able to restrain any single state or coalition of states from exercising outright domination over others."[2] In light of this, we can not allow the shouts of "hollow force" that now shower the halls of our once mighty armed forces. The claims that we can no longer fight at the same level abound and contain more than just a smattering of the truth. The fact is, that we are ***not*** the same force coming out of the Cold War that we were during the Cold War. This is not all bad, and the truth is that we were due for a cut. We had enjoyed years of build ups in both people and technology and the time had come to start to pare back to a leaner, capable fighting force.

The key to the matter, is in the word "capable." How we define this single word will decide the future shape for our forces. Do we mean "capable" of defeating all enemies? Do we mean "capable" of defeating only smaller, weaker enemies? Or, do we mean "capable" of defeating all enemies that threaten the national security of the USA? Certainly, no one wants to see the security of the USA threatened, so it is safe to say that our definition of a "capable" force should be one that can defeat all enemies that threaten the national security of the USA. This statement is in direct agreement with the current United States Foreign Policy.

With this in mind, this paper will present the view that a "capable" force in terms of our definition, must include the B-2 bomber. The role that the B-2 bomber plays in our nation's defense is vital to the continued freedom of our nation. In these times of military cutbacks and force reductions, it has become much more than a technological plaything, it has become a weapon that may decide if the USA can continue in its role as the preserver of world peace and defender of democracy.

The reasons for such a powerful statement rest in the fact that in times of a world wide crisis, the US has come to accept the fact that it will have the luxury of time to build up forces and prepare for battle. If recent history has taught our enemies anything about us, it is not to give the United States any time to build up forces in theater prior to the start or escalation of hostilities. The Gulf War has taught us many valuable lessons and we would be remiss to think that our potential enemies have not analyzed the conflict and learned lessons of their own should they be forced to fight the United States.

> "*For a number of reasons we know it will be very unlikely that we could replicate Operations Desert Storm and Desert Shield in the future. In*

> *such a major regional contingency of tomorrow, we doubt our adversary would grant us the reaction time and the initiative that Saddam Hussein provided in 1990 and 1991*."[3] Gen. Joseph P. Hoar CINC, CENTCOM

Looking at the current world climate and the recent conflict in the Gulf, it is apparent that an enemy can do irreparable damage while invading other countries. In the case of the Gulf War, the Iraqis stopped short of the Saudi Arabia border and allowed us enough time to perform a massive build-up prior to escalation. In a Korean crisis, the fact that Seoul, the capital of South Korea and a city strategically vital to a South Korean war effort, is located within 50 kilometers of a known hostile enemy, makes a challenging scenario even without the current military reductions. What are the chances that the North Koreans will give us ample time to build up our forces should they decide to invade South Korea?

> *The North maintains enormous ground forces just north of the Demilitarized Zone. The are in formations optimized for a sudden, massive strike southward toward Seoul. In recent years, these forces have increased their mobility and flexibility, improving their capability to threaten prepared defenses*.[4] Dr. Robert Gates, CIA

Complicating matters is the fact that we are withdrawing forces that have been forward based and deterring this kind of scenario. All throughout the world, the United States is in the process of either cutting back or completely withdrawing forces in other countries. This puts some of our closest allies in potentially tight spots should a conflict break out and places United States foreign interests at risk.

A long range bomber force has the advantage of being able to strike anywhere in the world at a moment's notice. They do not require massive buildups as they can fly their missions from US bases and either recover to the US or, if possible, recover to a more forward located base like Diego Garcia. The question we must ask ourselves about

a long range bomber force is, does it fit in the way the US will, or should fight a future conflict? It is in this light that the B-2 shines like no other aircraft. Only the B-2 can offer long range ***and*** stealth; an ability that can be decisive in future scenarios. Fortunately, the scenarios in which the B-2 can best be used, are also the ones that we are likely to become involved in the future. Those scenarios that rely on our ability to either slow or halt an enemy front line invasion force are ideally suited for the B-2. It is here that the stealth and long range characteristics of the B-2 can best be used and the only question that remains is will we have enough to accomplish the task?

Although this paper will make the case for more B-2's than are currently planned for, or at least, keeping the production lines open so that more may be rapidly produced should war become an eventuality, it is not meant to suggest that the B-2 is the "only game in town." Far from this, the realization that the B-2 has its place in the overall strategy of the USAF and the DOD, and that this role relies on the ability of other weapons systems to do their jobs, is ever present. The fact is that the B-2, nor any other weapon system, is capable of winning ***every*** potential conflict that may arise in the future on its own. In our modern, specialized world, we have come to rely on "special" tools to perform "special" tasks. The same holds true for wars. While this paper will show that the B-2 is the weapon of choice for conflicts involving front line invasion forces, it is not ideally suited for air to air combat against an enemy air invasion force.

The B-2 offers all of the former Soviet Union's tenets of military doctrine: speed, shock and surprise: Speed, that only a long range bomber can offer as it rapidly responds to conflicts world wide, shock in the large payload it can accurately deliver through the aid of Precision Guided Munitions (PGMs), and the surprise of a stealth attack.

The B-2 is the only weapon system in the inventory that can offer all of these characteristics in one neat package. Smaller aircraft, although some are just as stealthy, simply do not have the range and payload capability. The payload capability of the B-2 can serve the purpose of either precision bombing multiple targets using PGMs, or area bombing single targets or massed enemy formations with conventional munitions. Carriers still need the time to steam over to the conflict, and this time is significantly longer than it would take a B-2 force to fly over and back. Further complicating matters, is the logistics train that must follow which also requires a significant length of time. While the B-2 is ideally suited for the task of responding in force to a scenario that requires a rapid response over long distances, it must be supplemented by other forces as soon as they become available. As the B-2 force is holding the enemy, other forces must be rapidly on their way to the theater so as to apply the final decisive blows. The B-2 by itself, will not and cannot defeat all enemies in all situations. It can however, be a decisive force uniquely capable of halting or at least slowing a front line invasion force anywhere in the world.

This paper will show that the B-2 is the weapon of choice for halting or slowing an enemy front line invasion force due to its long range, large payload and stealth characteristics. It will also show that the B-2 delivers the most "bang for the buck" when compared to other major weapon systems in terms of cost per weapon delivered. Finally, it will propose the U.S. continue procuring the B-2 and ensure that it develops the proper munitions to maximize its potential.

[1] George Bush, *National Security Strategy of the United States,* The White House, January 1993, ii.

[2] House, *Regional Threats And Defense Options For The 1990s: Hearings before the Defense Policy Panel and the Department of Energy Defense Nuclear Facilities Panel of the Committee on Armed Services,* 102d Cong., 2d sess., 1992, 369

[3] Ibid, 64.

[4] Ibid, 320.

Chapter 2

The North Korean Model

Current United States military force structure is based on supporting 2 (two) major regional contingencies at the same time. A Middle East scenario and a Southeast Asia (Korean) scenario have been the most popular for fpr analysis due to the obvious reason that they are two of the world's most volatile "hot spots."

While it is recognized that the Middle East has much potential for conflict, this paper will focus on possible conflicts on the Korean peninsula. The recent statement of Senators Sam Nunn and Richard Lugar helps demonstrate the potential for conflict here, when they describe North Korea as an "unpredictable country that could respond militarily to diplomatic and economic pressure."[5] Their main concern is that the United States must be especially watchful and guard against a scenario where the North Koreans can attack the South with little or no advance warning. To this end, they suggest that the United States, together with South Korea, must provide a credible deterrent against attack along with bolstering intelligence systems and personnel. The instability and unpredictability of the Korean peninsula are two reasons for using a Korean scenario to evaluate the viability of attacking fielded forces through the use of long range bombers. Some of the other reasons are: the difficulty of the terrain (mountainous terrain); the close proximity of Seoul, (South Korea's capital,) to the Demilitarized Zone (DMZ); the probable speed with which a North Korean invasion force would invade the South; and the fact that forces are currently in place along a DMZ dividing the two countries. The Korean scenario becomes even more difficult in terms of halting a mobile invasion force due to

the inadequate advanced warning this scenario provides.

Lessons from the Past

In sharp contrast to Operation Desert Storm, where we enjoyed months in which to build up and train forces for a conflict fought in open, flat terrain against stationary, dug in troops, a conflict in Korea promises to be different. It would be naive of us to believe that our enemies have not learned from the conduct of the United States military forces in the Gulf War. In fact, one of the first lessons likely learned was that if the United States is given enough time to build up forces in theater, it is the most formidable of foes. The United States must assume that North Korea will not ignore this lesson should it decide to attack South Korea. It would be much more likely to advance into Seoul and further south, as quickly as possible, while at the same time denying as many airfields to the US forces as possible through Special Forces infiltration and operations.[6] This would serve to deny the US the ability to base air assets in theater, significantly affecting the air war and the support that the USAF would be able to offer any ground forces on the peninsula.

Nature of the Threat

According to the 1992 Joint Military Net Assessment, the first hours of a North Korean invasion may be the most critical. "Wargaming analysis of this scenario suggests that the DPRK offensive achieves most of its success relatively early. Once sufficient US forces have arrived in Korea, US and ROK forces successfully stop DPRK advances." The assessment also goes on to say that Reserve forces are required and that "1993 mobility forces do not deliver Army heavy forces as fast as desired by scenario guidelines."

Add to this the close proximity of Seoul to the DMZ, and the possibility of a surprise offensive capturing Seoul is a distinct threat.

In the face of a threat where the rapid advancement of enemy forces into friendly territory is a primary concern, one of the first tasks would be to halt, or at least slow the invasion force with a minimum loss of friendly territory. With the current and projected cut backs in U.S. military forces, and the decreasing amounts of forward basing available to our military, it appears the US will become increasingly dependent on long range bombers to stop the assault. Long range alone offers the ability to strike an enemy from the continental United States. With the right mix of weapons systems, our long range bomber force will be the only force able to enter the fray with sufficient numbers to stop, or at least slow, the enemy's invasion force long enough to deploy the rest of the military forces necessary to defeat the enemy.

A Likely Scenario

In attempting to define a scenario where North Korea invades South Korea, the first step is to review the history of the peninsula and North Korean military doctrine. In 1950, then communist North Korea decided to try and unite the peninsula by force. It started the war by launching an invasion force that marched to Seoul, while at the same time, attacking in the south at Pusan and attempting to deny the South Koreans and the United States access to air fields.

In any type of conflict that the United States gets involved in on the Korean peninsula, it is important to keep in mind one of the key lessons of the Korean War and the Vietnam War. That democracies can not fight long wars in far away lands, has long been

one of the accepted lessons of the Korean War. In any future conflict, the political and military leaders of the United States must bear in mind the history lesson of the Korean and Vietnam wars. Both wars met with opposition from the American public when they started to become prolonged and civilians started seeing the American and enemy causalities of war. Once public support started to wane, the mighty United States had to look for quick solutions to intractable military situations while trying to save face so potential adversaries would not view actions as a sign of weakness. In one instance, this led to negotiations with the enemy and a military presence in a foreign country that has lasted for almost half a century. In the other case, this public pressure resulted in a hasty negotiation for peace and a military withdrawal that allowed the enemy to take over the country within 5 years.

In light of these historical lessons from the past conflicts with Korea and Vietnam, the United States can not plan on fighting a long, protracted war far away from home. In the case of a scenario where North Korea invades South Korea, the United States must be able to respond swiftly with the right mix of weapons to ensure that the enemy is defeated, or at least held in check, in the shortest time possible with the least amount of casualties possible. Add to this the lesson that many learned from Operation Desert Storm that the United States' precision weapons can defeat an enemy with little collateral damage and fewer casualties, and it is clear that the United States must be prepared to fight a short war and maintain a low casualty rate. In this type of climate, it is not hard to imagine a scenario where an enemy invasion force must be halted or at the very least, slowed within the first few days of the attack, for the United States to have a

chance on bringing the conflict to a quick end on terms favorable to the United States and her allies.

This then, becomes the backdrop for a scenario in which North Korea decides to mount an invasion of South Korea, with little or no advance warning. While it may be argued that the possibility of a "surprise" attack by North Korea is unlikely in light of the vast amounts of attention North Korea has been receiving, many experts still believe that a North Korean attack will give little or no advance warning. North Korea is one of the most secretive countries in the world. It has been poised for war constantly since the end of the Korean War, with forces maintaining constant readiness on the DMZ, prompting General RisCassi to say that "a North Korean attack would provide at most several days of warning and preparation."[7] To be truly prepared for future conflict on the Korean peninsula, the possibility of a "surprise" attack by the North Koreans sometime in the future, simply cannot be ruled out.

One of the possible scenarios can be played out much the same as the start of the Korean War back in 1950. On June 24, 1950, North Korea launched an all out invasion into South Korea with the intention of uniting the entire country by force. Over 135,000 ground forces from the North Korean Peoples Army (NKPA) engaged approximately 100,000 Republic of Korea (ROK) forces in a "blitzkrieg" like attack. In a similar present day or future scenario, the North Koreans could quickly mount an attack on Seoul with the intent of invading South Korea for the purpose of once again trying to unite the peninsula by force. Certainly, if the North Koreans have learned anything at all from history, the attack would come with little or no advance warning. It is possible that such an attack could catch South Korea and the United States off guard, and the North Koreans

could be immediately successful in overtaking Seoul. Using the element of surprise, the North Koreans could press further south, overtaking South Korean airfields along the way, while using Special Operations Forces to launch attacks from the rear, coming up through the south. This type of scenario would serve to effectively deny the United States and South Korea critical airfields from which a theater air campaign could best be launched. Simultaneously, the North Koreans would continue to prove that it has learned the lessons of past fights with the United States by making amphibious landings, and mining harbors in the south, in an effort to deny United States amphibious forces from mounting a successful landing and repeating Inchon. The forces from the south could then mount attacks on the ROK forces rear, while the advancing northern forces continue to press ROK forces to the south and into the waiting guns of the southern advance.

The United States could try to mount a successful air campaign in an effort to blunt the attacking North Korean invasion force but, the effects of military draw-downs and cutbacks would have left only token forces in the area and no long range capability to speak of. At least 6 months to build up forces and support infrastructure likely would be required to conduct a major campaign necessary to help the ROK forces stave off the invaders seems too long. With every passing month, the North Koreans gain momentum and continue to overwhelm the ROK and US forces.

While arguments can be made that this is not a likely scenario, many of our senior leaders feel that an attack on South Korea by the North is not all that unlikely. One of the reasons that North Korea might mount an invasion may be the collapse of the Soviet Union, a major supplier of arms and political support. While the CIA suggests that North Korea's weapons are becoming obsolete and will not be replaced by the Soviet Union or

China as rapidly as in the past, if at all, this may bring about a more dangerous period in the near term, North Korean strategists may push for an attack on the South before they lose their military advantage. Further, a perceived deterioration in the ability of U.S. forces may strengthen that position.[8] It's not too difficult to look at the force structure of the North Korean military forces and see what type of war they are planning to fight. Table 1 indicates the type of forces the North Koreans presently have. At a glance, one of the most glaring areas is in the North Korean Air Defense forces. They have a large number of Surface to Air Missiles (SAMs) and Anti Aircraft Artillery guns (AAA) in an apparent effort to avoid air strikes within Korea as happened during the Korean War. Looking at the NKPA ground forces, one can make a logical assumption that the massive amount of firepower available is geared to offensive, rather than defensive operations. The type of terrain and the fact that the North Koreans have become adept at tunneling and "digging in" forces in naturally hardened cover, doesn't necessitate firepower of this magnitude for defensive operations. Looking towards the composition of North Korea's naval forces, it would appear that likely operations would be mining harbors and possible landing zones, securing beach heads for amphibious operations with Special Operations Forces to enhance the attacking ground forces by exploiting weaknesses in the South's rear. While the North

		North Korea
Total Army:		1,000,000
Tanks		4,200
APCs		2,500
Field Artillery		6,800
Multiple Rocket Launchers		2,280
Mortars		9,000
Total Navy:		45,000
Submarines		25
Destroyers		0
Missile Attack Boats		45
Amphibious Craft		231
Mine Warfare		23
Total Air Force:		82,000
Total Combat Aircraft		780
Bombers		80
Fighters		694
Transport		305
SAMs		10,300
Air Defense Guns		8,800
* N. Korea Total Combat A/c Source: ***The Military Balance***	includes 25 ***1993-1994***	helicopters

Table 1

Korean Navy may be no match for the United States Navy, in the first few decisive days of war prior to their arrival, they may have enough to overwhelm the South.

The last general area to observe is the North Korean Air Force. It appears to be designed to move men and equipment throughout a theater of operations while providing Close Air Support (CAS) to its advancing ground forces. This is much the same way they utilized their air force in the Korean War, and one can only believe that they have learned at least some of the historical lessons of the importance of good CAS. While these numbers do not appear staggering at first, taken in context and comparing them to

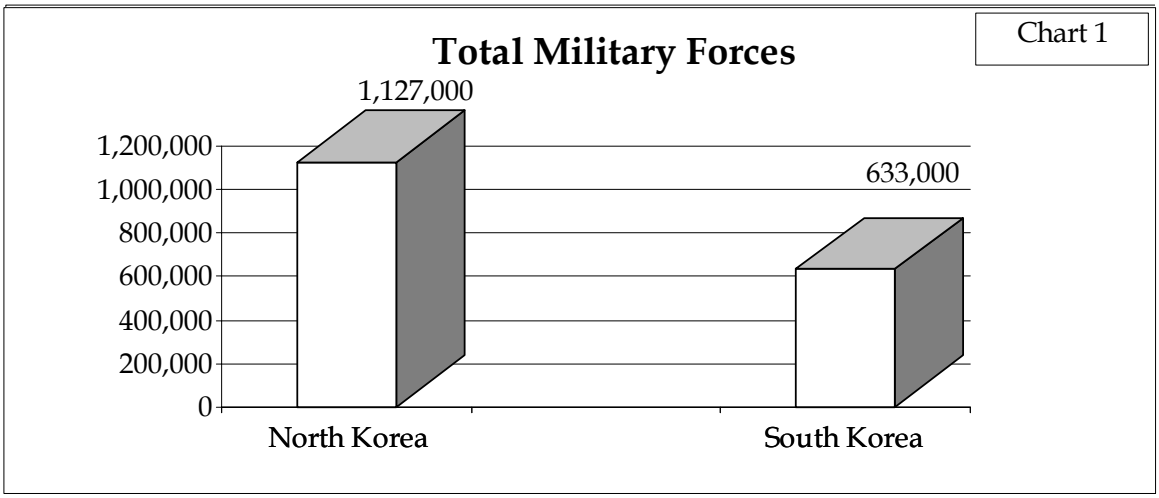
the Republic of Korea's (ROK's) military forces, one can immediately see the disparity in numbers of total forces especially, offensive forces. Table 2 shows the comparisons. To be sure, a case can be made that the state of the North Korean Army's equipment is inferior to that of the ROK. One could also make the argument that the training of the NKPA troops is also inferior to that of the ROK.

Looking back in history, these arguments were also made during the late 1940s and all the way up to the first days of the invasion of South Korea.[9] Not wanting to repeat mistakes of the past, one would be wise to take into account the skill and tenacity with which the NKPA fought in the 1950s, and expect the same relative skill level enhanced with more modern, although not quite state-of-the-art, weapons and equipment. Another important point to remember is that in 1950, the NKPA only outnumbered the ROK by 35,000 troops. The numbers were approximately 135,000 NKPA and 95,000 ROK forces.[10] As the chart shows, should war break out, the NKPA would currently enjoy almost a 2:1 advantage from the start, discounting any active reserves. This would reasonably lead one to surmise that the NKPA would strive to move quickly in order to take advantage of their numerical advantage and press the war into the south as

	North Korea	South Korea
Total Army:	1,000,000	520,000
Tanks	4,200	1,800
APCs	2,500	1,550
Field Artillery	6,800	4,400
Multiple Rocket Launchers	2,280	140
Mortars	9,000	6,000
Total Navy:	45,000	60,000
Submarines	25	4
Destroyers	0	9
Missile Attack Boats	45	11
Amphibious Craft	231	50
Mine Warfare	23	11
Total Air Force:	82,000	53,000
Total Combat Aircraft	780	445
Bombers	80	0
Fighters	694	418
Transport	305	41
SAMs	10,300	850
Air Defense Guns	8,800	600

* N. Korea Total Combat A/c includes 25 helicopters
** ROK Navy includes 25,000 Marines
*** ROK Total Combat Aircraft includes 86 US aircraft
Source: *The Military Balance 1993-1994* published by Brassey's for the IISS

Table 2



quickly as possible before any support from the United States or other nations can come to the aid of the ROK forces.

In this scenario, it is vital to immediately blunt the invasion force of the NKPA, while buying time to transport troops and equipment into the theater. If the scenario were the same as in 1950, the Far Eastern Air Forces (FEAF) would be available to fly combat sorties on short notice and lend some air capability in the theater without the long wait for a build up. This is not the 1950s however, and the best the United States can offer in these times of military cutbacks, draw-downs, and significantly less forward bases and pre-positioned troops and equipment, is a long range bomber force. Only a long range bomber has the capability to strike at the heart of the Korean battlefield from the continental United States. Only long range bombers can immediately respond in force with the amount of firepower necessary to present a credible threat to an enemy invasion force. Finally, only the United States long range bomber force offers the mix of stand-off weapons, precision guided munitions (PGMs), and stealth.

Stealth brings a new dimension and variable into the calculation an enemy must make when pondering the outcome of a confrontation. The B-2 complicates this equation further by offering long range, precision, and stealth all in one package. The B-2 alone has the capability of being able to take off from the continental United States, strike anywhere in the world with massive firepower, and do all this while avoiding detection by the enemy. This makes any target that is identifiable "open season" and offers capability like no other nation enjoys. With 20 B-2s in our arsenal, the United States Air Force will possess the capability to respond to an invasion of South Korea in the role of a "force multiplier" for the ground and air forces already in theater. Combine the capability of the

B-2 with the stand-off capability of the B-1 and the B-52, and you have the tools necessary to stop the invasion in its tracks, or at the very least, significantly slow its rate of advance enough to allow a theater build up. This analysis will show however, that acquiring additional B-2s in our inventory, gives the United States the capability to halt an NKPA invasion force before it has any chance of picking up the momentum necessary for a North Korean victory.

---

[5] John Diamond, "Senators suggest arming S. Korea," *Montgomery Advertiser,* 24 February 1994.

[6] House, *Regional Threats And Defense Options For The 1990s: Hearings before the Defense Policy Panel and the Department of Energy Defense Nuclear Facilities Panel of the Committee on Armed Services,* 102d Cong., 2d sess., 1992, 241.

[7] Ibid, 243.

[8] Ibid, pp. 320-321.

[9] Just about every historical account of the Korean War discusses the United States opinion that the ROK forces were much better trained than they actually were. There is also discussion that the common feeling of the NKPA forces was that they were inferior largely due to their communist training and backing. As it turned out, neither was the case and the United States was greatly surprised at the skill and competency of the NKPA forces.

[10] Max Hastings. *The Korean War*, (New York, Touchstone, 1988), pp. 52-53.

Chapter 3

Cost Effectiveness of the B-2

Although the B-2 is touted as the most expensive weapon system in the Air Force's history, it is also one of the most cost effective in terms of the total cost per weapon delivered. The main source of concern over the B-2 has not been it the total cost of the program, but most are outraged over the price of each airframe.[11] Take for example a Newsweek article from January 1989. It compares the price of a B-2 to that of a B-70, a B-52, and six Manhattan skyscrapers.[12] The article makes the case that the B-2 is projected to cost $520 million dollars each, as opposed to an estimate of $62 million each for the B-70 in 1960.[13] While these statistics are interesting, they do little to show the true advantages of a weapon system like the B-2.[14] In an effort to try to shed more realistic light on the subject, this analysis will show a comparison between the B-2, the F-117, and a Carrier Battle Group. For the purposes of this analysis, the assumption is made that these forces will be available sometime in the late 1990s. This is the starting point for these types of forces and the basis for using these "leading technology" type weapon systems.[15]

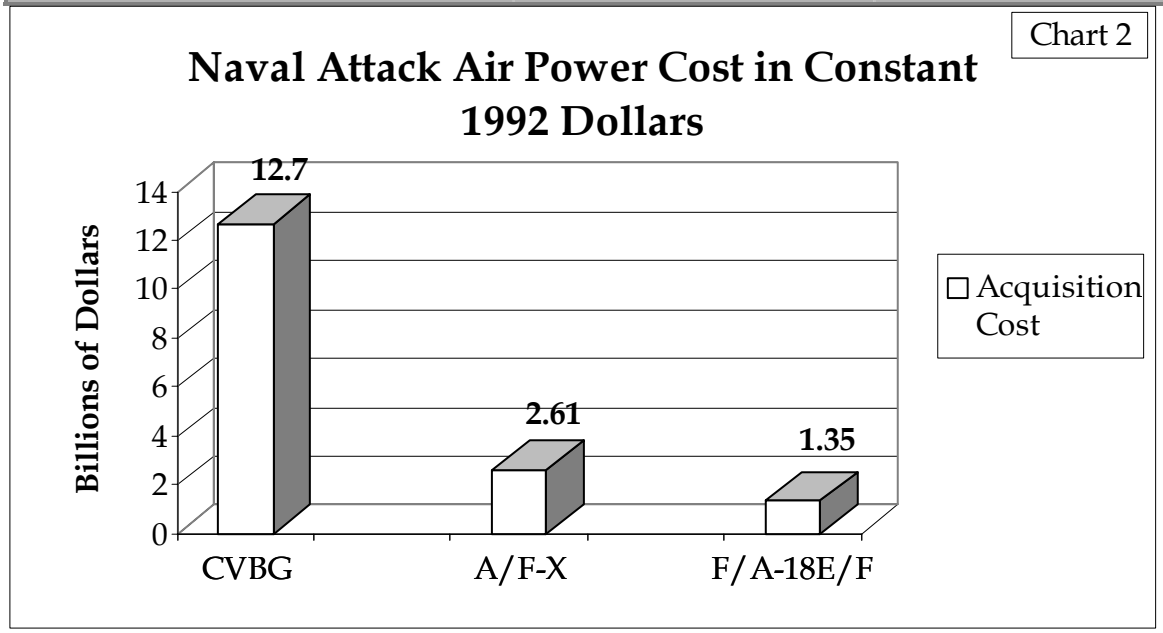
How Much Does It Cost?

The basis for the first part of the analysis will be the cost of one (1) Carrier Battle Group (CVBG) in 1992 dollars. According to a Congressional Budget Office Staff Memorandum[16], a single CVBG including only all ships, costs 12.7 billion dollars to acquire.[17] Adding the cost of attack aircraft to the CVBG, and the cost rises to $20.62 billion. This is based on 20 F/A-18E/F and 20 A/F-X attack aircraft per carrier. No allow-

ance is made for support aircraft like F-114s provided for carrier defense, Search and Rescue (SAR) aircraft, Suppression of Enemy Air Defenses (SEAD) aircraft, Tanker aircraft, or any other aircraft other than the F/A-18E/F and the A/F-X.[18] Table 3 shows the cost of the CVBG and all attack aircraft while Chart 2 graphically illustrates the comparison.

	Cost of Naval Attack Air Power	
Type Force or Weapon System[a]	Number of Weapon Systems Bought	Acquisition Cost[b] (Billions of Dollars)
CVBG	1	12.7
A/F-X	20	2.61
F/A-18E/F	20	1.35

a. CVBG only includes all ships (doesn't include support aircraft/equipment)
b. cost is in constant 1992 dollars
Source: 1991 CBO Staff Memorandum Using B-2 Bombers For Conventional Naval Missions



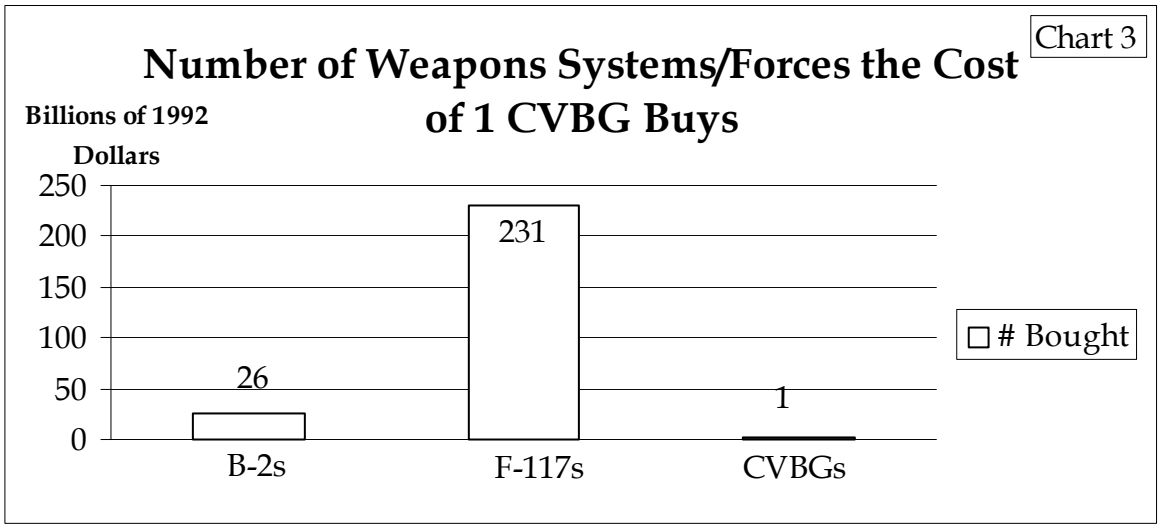
Totaling these figures, the cost of a Carrier Battle Group is determined to be $16.66 billion. The question now becomes, for the price of a single CVBG, how many B-2s and/or F-117s can be bought? This is important to determine, because in times of budget cutbacks, the Department of Defense is rightly concerned with not only a "quality force," but a force that is capable of providing the most "bang for the buck." The criteria is to be able to deliver the most firepower for the least amount of cost. In attempting to determine this, one must first examine what forces $16.66 billion buys. Table 4 and Chart 3 illustrate this. At this point in the analysis, the initial reaction is to immediately go with the F-117 as the weapon system of choice due to the large numbers bought. Logic however, points to other costs incurred by such a large force in both manpower, operating costs, and other costs such as the cost of additional tankers re- quired by such a large F-117 force for it to retain long-range strike capability

Force Structure 1 CVBG Buys

Total Acquisition Cost for 1 CVBG in Billions of Dollars[a]	**# B-2s 16.66B Buys[b]**	**# F-117s 16.66B**	**# CVBGs 16.66B Buys**
	26	**231**	**1**

a. based on CBO estimates
b. based on Northrop estimate of 650m per a/c vs. CBO estimate of 540m
c. based on estimate of 59m per a/c + 25% of KC-135R
Note: CVBG only includes all ships (doesn't include support aircraft/equip)
Sources: 1991 CBO Staff Memorandum and Northrop 1992 B-2 Fact Book

Table 4

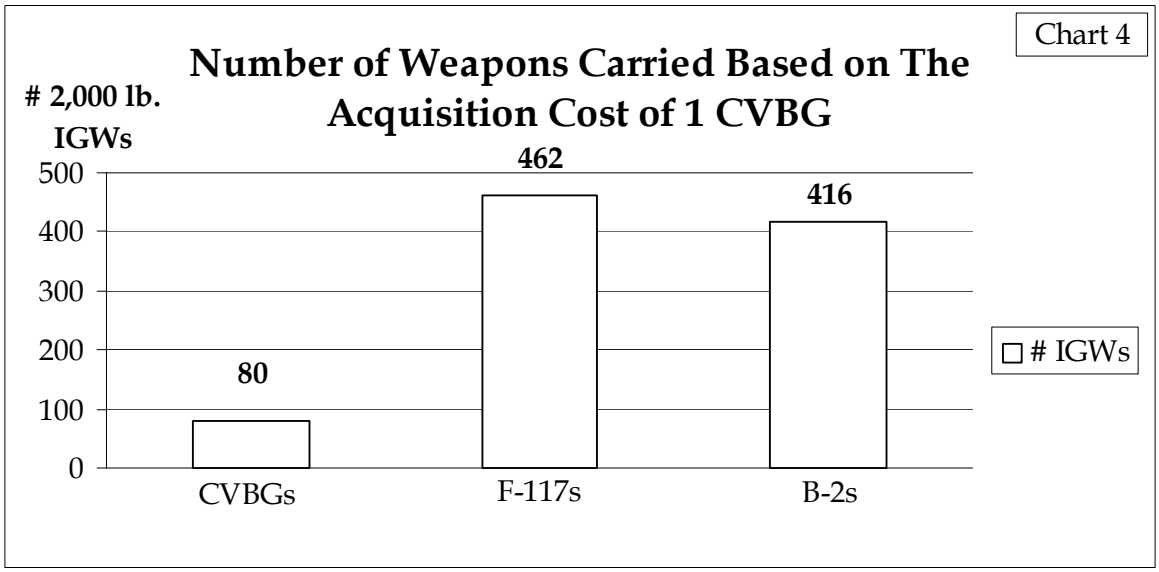


without sacrificing payload. Because of this fact, the next step is to examine the number of weapons each force brings to bear on an enemy and also the cost per weapon delivered.

As far as the amount of weapons carried by each of the "bomb droppers," once again, the edge goes to the F-117 due to the sheer numbers as Table 5 and Chart 4 show.[19]

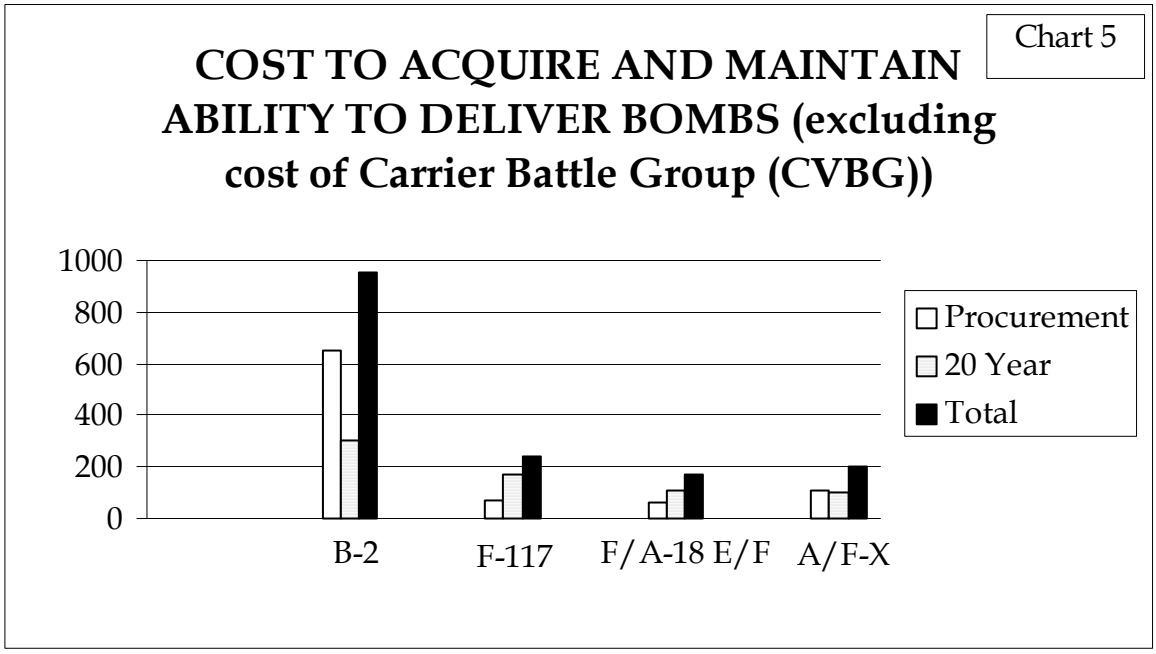
Number of Weapons Carried Based on the Cost of 1 Carrier Battle Group			
Total Acquisition Cost (in billions of 1992 $)	**# Weapons 1 CVBG Carries**	**# Weapons 231 F-117's Carry**	**# Weapons 26 B-2's Carry**
16.66[a]	**80**	**462**	**416**
a. CVBG includes all ships only (doesn't include support aircraft/equipment) **Note: CVBG and F-117 # weapons carried based on 2 weapons per a/c times # of a/c. B-2 # weapons carried based on 16 weapons per a/c times the # of a/c**			

Table 5



As the chart shows, the B-2 carries 5.2 times the number of bombs that all the attack aircraft on a CVBG can carry, and the F-117 carries 5.77 times the payload of the CVBG attack aircraft, and only 1.11 times the payload of all B-2s. While this is a significant point, it still does not get to the bottom line of how much each weapon system costs to deliver one bomb. Table 6 and Charts 5 and 6 begin to put the cost issue into perspective as they show the Cost Per Bomb ***excluding*** the cost of the CVBG.[20]

Cost to Acquire and Maintain Ability to Deliver Bombs					
Aircraft Type	**Procurement Cost**	**20 Year Operating Cost**	**Total**	**Bombs Carried**	**Cost Per Bomb**
B-2	**650**	**302**	**952**	**16**	**59.5**
F-117	**72**	**171**	**243**	**2**	**121.5**
F/A-18 E/F	**60**	**111**	**171**	**2**	**85.5**
A/F-X	**105**	**98**	**203**	**2**	**101.5**
Source: Northrop Corporations 1992 B-2 Stealth Bomber Fact Book					
		Table 6			



The first Chart in this series, shows the Procurement (or Acquisition) Cost of , the 20 Year Operating Cost, and the Total Cost for each weapon system excluding the cost of the CVBG, while the second chart shows the number of bombs carried and the Total Cost per bomb of each of the weapon systems again excluding the cost of the CVBG. While this presents the point that the B-2 is certainly more cost effective in

terms of Total Cost Per Bomb, a more accurate representation is seen by adding in the cost of the CVBG as in Table 7 and Chart 7.

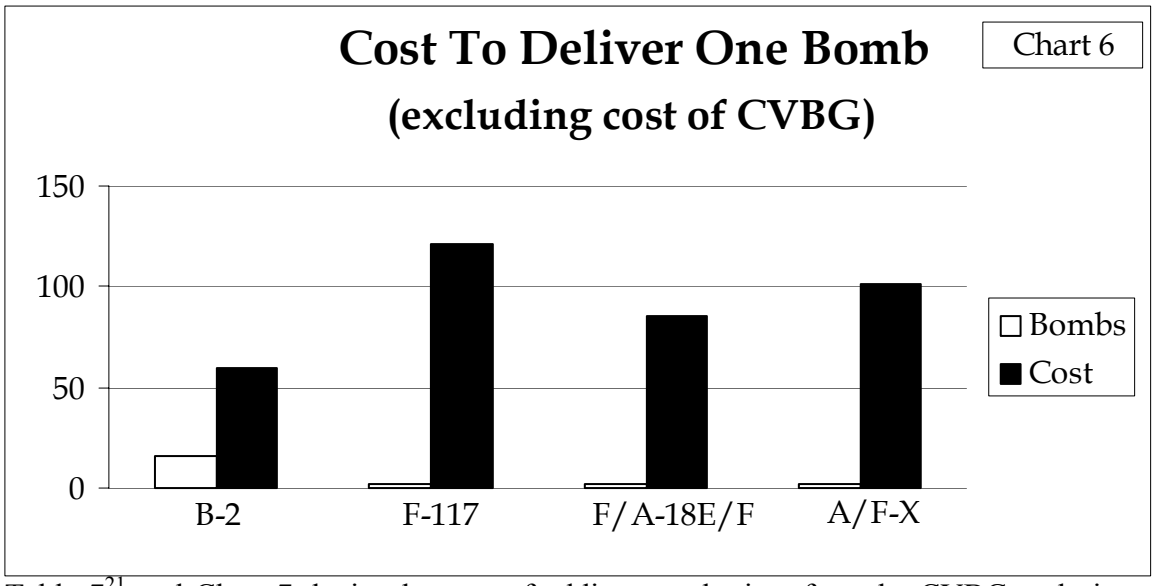
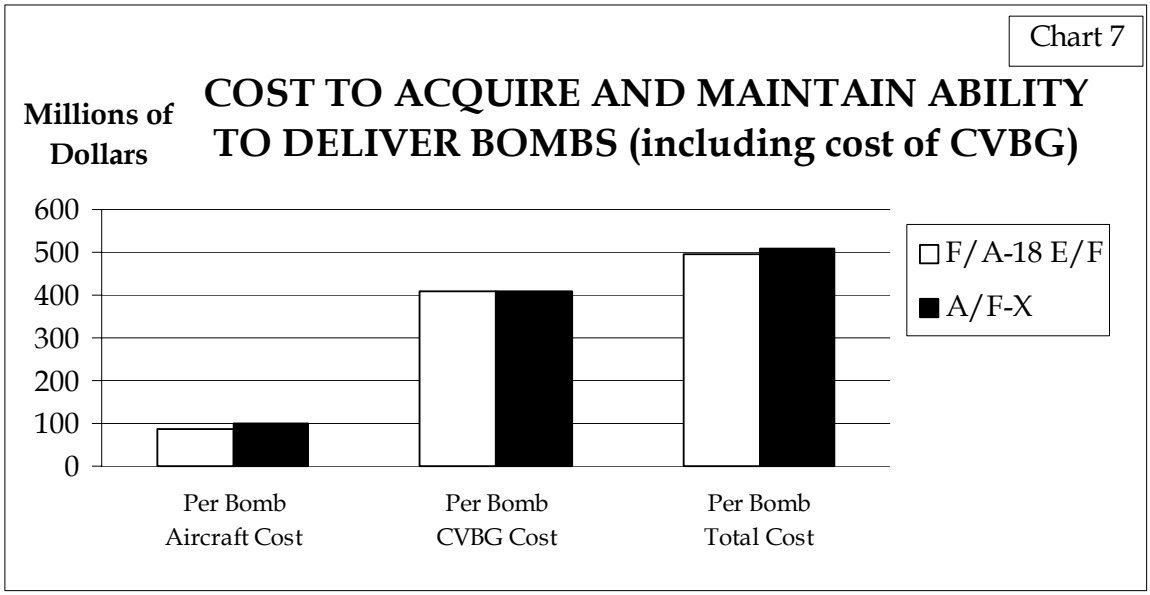


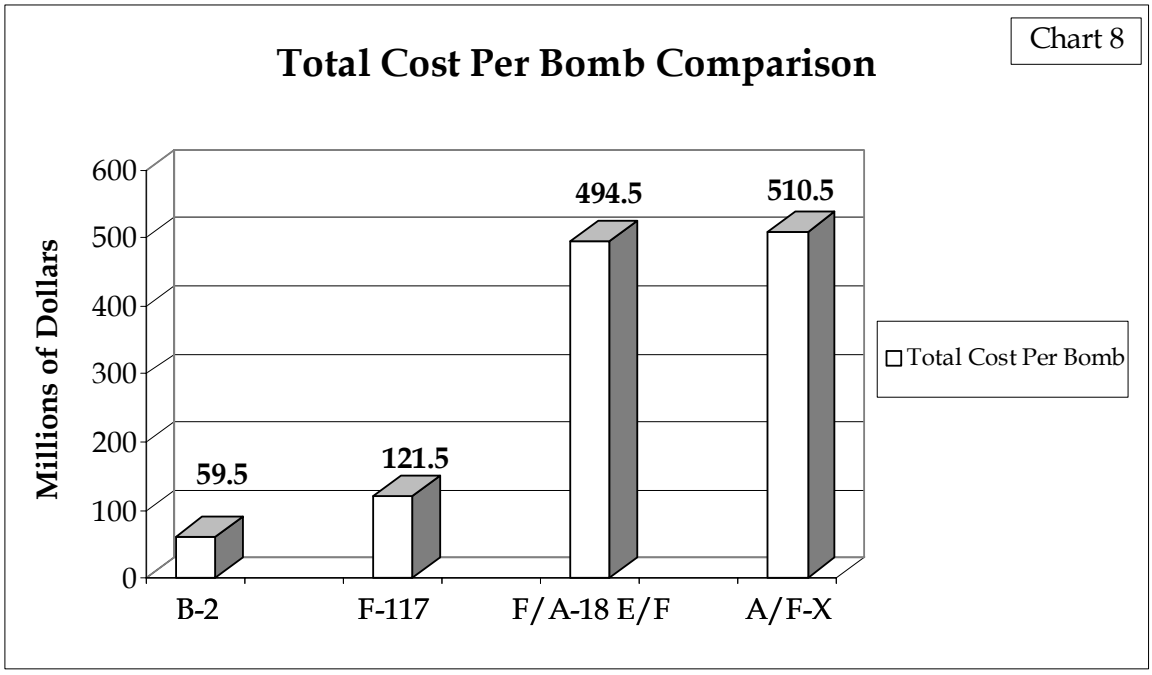
Table 7[21] and Chart 7 depict the cost of adding attack aircraft to the CVBG and give a Total Cost Per Bomb including all ships plus attack aircraft in one CVBG.

Bomb Cost including CVBG			
Aircraft Type	**Aircraft Cost Per Bomb**	**CVBG Cost Per Bomb**	**Total Cost Per Bomb**
F/A-18 E/F	**85.5**	**409**	**494.5**
A/F-X	**101.5**	**409**	**510.5**
Sources: **Northrop's *1992 B-2 Stealth Bomber Fact Book* & *1991 CBO Staff Memorandum***			
	Table 7		



Finally, Table 8 and Chart 8 put it all together. As the Table and Chart depict, once the CVBG cost is figured into the equation, the cost of Naval Attack Air Power is by far, the most expensive of all weapon systems compared. Furthermore, one can see quite clearly, that the B-2, the aircraft with the highest sticker price per unit, is the most cost effective in terms ***of Total Cost Per Bomb Delivered***.

Total Cost Per Bomb Delivered	
Aircraft Type	**Total Cost Per Bomb**
B-2	**59.5**
F-117	**121.5**
F/A-18 E/F	**494.5**
A/F-X	**510.5**
NOTE: All costs include procurement costs and 20 year operating costs	
Table 8	

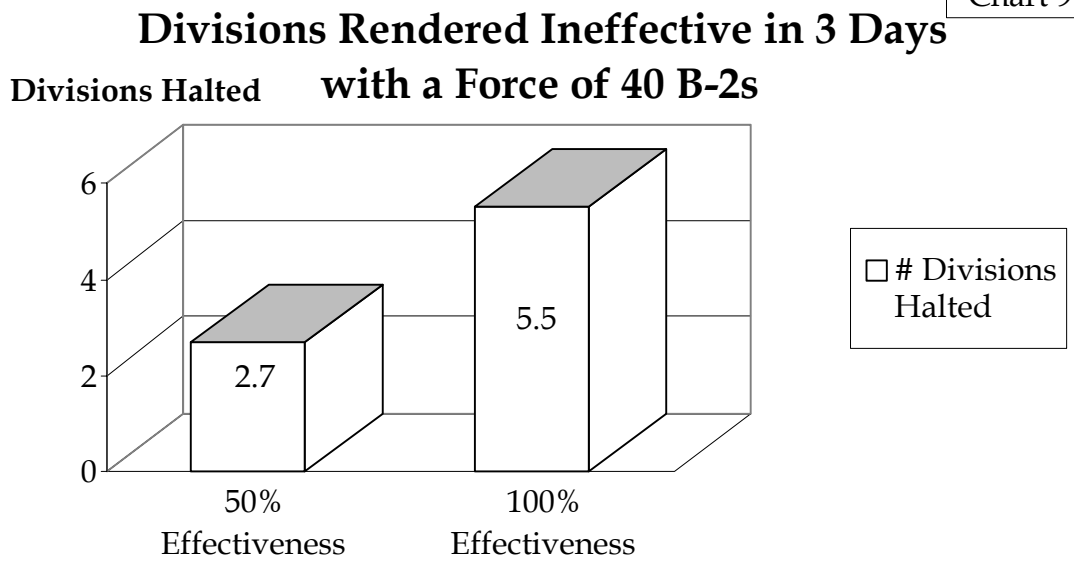


Effect of More B-2s

By giving up the acquisition cost alone of a single CVBG, the US could buy 26 more B-2s. By obtaining just 26 more B-2s, of which 24 would be available at any given time, the result would be an increase of the B-2 force by 150%. It also means that based on the same criteria as used earlier, this B-2 force of 40 aircraft would drop 640 weapons per day for a three day total of 1920 weapons in 3 days.[22] If one assigns a weapon effectiveness rate of 100%, then that means this B-2 force has the capability of destroying 5.5 NKPA divisions. At a weapons effectiveness rate of 75%, this still halts 4.1 NKPA divisions; and at a very conservative rate of only 50% weapon effectiveness, 2.7 NKPA divisions are still halted within 3 days.[23] Table 9 and Chart 9 illustrate this point.

Destructive Power of a 40 Aircraft B-2 Force				
Total Bombs Delivered in 3 days	**Total Armor Destroyed @50% effectiveness**	**Total Armor Destroyed @100% effectiveness**	**Divisions Destroyed @50% effectiveness**	**Divisions Destroyed @100% effectiveness**
1920	**960**	**1920**	**2.7**	**5.5**

Chart 9



Effect of BAT Munition

One of the leading edge technology weapons holding much promise when combined with the stealthy lethality of the B-2 is the BAT (Brilliant Anti-Tank submunition.) The BAT submunition is contained in a larger "dispenser" missile or bomb such as the TSSAM (Tri-Service Surface Attack Missile.)[24] Each TSSAM can dispense 44 BATs[25], and each B-2 can carry 8 TSSAMs.[26] Equipping our 40 B-2s with 8 TSSAMs each yields a total of 14,080 BATs on targets. Even at a modest 50% weapon effectiveness rate, this equates to 7,040 targets destroyed. Considering the total number of the NKPA tanks and

APCs total only 6,700, a force of 40 B-2s could destroy all NKPA tanks and APCs in a single day![27] This means that on the first day of the invasion, it is successfully halted and the battlefield is prepared for ground force insertion.

Solving The Bombing Problems

One question involved with the massive quantity of weapons that a single B-2 could deliver, is how is the problem of "bomb de-confliction" solved?[28] In the case of the B-2 carrying the TSSAM, or JDAM (Joint Direct Attack Munition) loaded with the BAT submunitions, this problem is solved by the sensor head within the submunition itself combined with the weapon's dispersal pattern.

Prior to launch, the weapon is programmed based on the enemy's formation. The weapon's timing and sequencing depends upon whether the enemy is in a "line array" or attack formation. Once programmed, the weapons are released at a rate that allows each submunition to "see" one target better than the rest. Electronically, the submunition would receive a series of electronic signals, with the target's signal closest to the submunition presenting a "spike" on the submunition's sensor. This would virtually allow each submunition to independently attack an individual vehicle or target.29 Based on a B-2 traveling at a nominal 400 miles per hour, if the weapons are released one tenth of a second apart, each weapon would be separated by approximately 59 feet.[30]

---

[11] Headlines calling attention to the price per unit have permeated newspaper and magazine articles since information about the B-2 program was released to the public. While the total cost has been brought up, the main focus has appeared to be on the B-2 being the most expensive weapon system in history.

[12] Gregg Easterbrook, "Sticker Shock: The Stealth Is a Bomb," *Newsweek,* 23 January 1989, 20.

[13] Ibid, 20.

[14] When deciding which weapon system to buy, one must keep in mind the fact that "sunk" costs, such as R&D, are lost forever. The cost of additional B-2s, that is those after the initial buy of 20 aircraft, does not include the cost of

R&D or other "sunk" costs, as they have already been paid for and will not be reassessed. The only valid reason to use the cost of "sunk" costs in a decision, would be if the system was either still "on the drawing board," or so new that the "sunk" costs have not yet been paid for, which is not the case with the B-2, the carrier aircraft, or the F-117. This is the reason that all costs cited do not include "sunk" costs for the weapon systems.

[15] In the past, when different attack forces were compared, a distinction was made between *strategic air, tactical air,* and *carrier air* forces. With the recent merger of SAC and TAC, this line has become more blurred than in the past with regards to *strategic* vs *tactical air*. In this study however, the F-117 is used as a comparison point for the traditional *tactical air.* Although it is not representative of traditional *tactical air* strike packages including all of the support aircraft that went with them, I believe that it is a valid representation of future *tactical air* that would be used in this type of scenario. As the F-117 packages don't require the additional "baggage" that traditional *tactical air* strike packages require, the total cost of the strike package is lowered. If anything, this would tend to "skew" the data in favor of the F-117 when compared to the B-2. The justification for using the F-117 strike force instead of the traditional *tactical air* packages remains the fact that this hypothetical scenario relies on a forces ability to rapidly halt, within the shortest time possible, an enemy invasion force. The required build-up time for traditional *tactical air* forces makes them much less desirable to use ***initially*** when the F-117 is available.

[16] Congressional Budget Office, *Using B-2 Bombers For Conventional Naval Missions,* CBO Staff Memorandum, September 1991.

[17] According to the CBO, 12 CVBGs cost $152.4 billion to acquire. By dividing this number by 12 (the number of CVBGs, I obtained a cost of $12.7 billion per CVBG. Again, according to the CBO, this only includes the cost of ships, and not aircraft associated with a CVBG. See CBO Staff Memorandum *Using B-2 Bombers For Conventional Naval Missions.* All dollar figures will be in 1992 dollars unless otherwise noted.

[18] Every effort has been made to portray the data in as neutral terms as possible. Although the B-2 and the F-117 do not require many of the other types of aircraft available in a CVBG, it would be misleading to suggest that the United States Air Force would not require support aircraft for an F-16, F-111, B-1, B-52, or other strike package. Therefore, only the CVBG "bomb droppers" are compared to the Air Force "bomb droppers."

[19] The weapon of choice that is used for this comparison is a 2,000 lb. variation of the all weather IGW, JDAM.

[20] The cost per bomb numbers presented in the tables and charts include the procurement (or acquisition) cost of the aircraft and the operating costs of the aircraft for a 20 year period. In the case of the F-117, the cost includes 25% of the acquisition and operating costs for a KC-135R tanker aircraft. This is due to the fact that the F-117 would most likely require aerial refueling support even if based in theater, as it did during the Gulf War. Experience shows that one tanker is required per 4 F-117s, therefore, the cost of the tanker is divided by 4 and then added to the cost of the F-117.

[21] The CVBG Cost Per Bomb was calculated by taking the procurement cost of a CVBG (12.7 billion), adding the 20 year operating costs (20 billion) of the CVBG, and then dividing by the number of bombs dropped by the CVBG F/A-18 E/Fs and the A/F-Xs (80).

[22] This number is based on the inertially guided 2,000 lb. JDAM. As previously discussed the B-2 has the capability to carry 16 of these weapons. Multiplying the number of PAA (Primary Authorized Aircraft) B-2s by the number of weapons carried in each (16) yields 640 weapons. Multiplying 640 by 3 (the number of days in which it is desired to stop a NKPA invasion force) yields 1920 weapons.

[23] These figures are based on the RAND conclusion that destroying 350 enemy armored vehicles results in halting one (1) division.

[24] David Hughes, "Extensive Simulation Guides BAT Design," Aviation Week & Space Technology, 11 October 1993, pp. 55-58.

[25] Ibid.

[26] Northrop Corporation, "B-2 Stealth Bomber 1994 Fact Book (Draft)", 3 November 1993, 3.

[27] While this assumes near perfect intelligence, it is a valid demonstration of the absolute best case scenario. At worst, if intelligence gives us 50% accuracy each time, and the BATs are only 50% effective, there are still over 7,000 BATs that will be effective against 3,350 correctly identified targets. This results in a 50% degradation of the NKPA tanks and APCs after just one sortie.

[28] How weapons keep from either flying into each other, or keep from all attacking the same target, has long been a problem when delivering large quantities of weapons. The solution to this problem is perhaps as revolutionary as the concept of stealth itself, and therefore, little is available on the subject and much of what is available is classified.

[29] Tank formations typically stretch out and cover an area of approximately 6 kilometers. If the B-2 is traveling at a nominal 400 miles per hour and releases the weapons at an interval of 1 second apart, they would be approximately 587 feet from each other (based on 1 mile = 5,280 feet, I take 400/60 which = 6.6666. 6.6666/60 = .1111 which is the number of miles traveled in 1 second. 5,280 x .1111 = 586.666 which = the feet traveled per second.

[30] Carrying the above calculations out a step further, dividing 586.666 by 10 yields the amount of feet traveled in one tenth of a second, 58.6666.

Chapter 4

The American Attitude

Americans have come to expect their military to be able to deliver victory in a short period of time with little casualties, and with no threat of damage to the continental United States. Recent wars have all been fought on others' territory and most recently, the conflicts have been extremely short in duration and have cost the United States little in terms of lives lost. These victories were made possible through the money invested in military technology and personnel during the Cold War period. This was a time that saw a military build up that was second to none in an effort to keep the Communist threat at bay. Only through a credible deterrent was the United States able to offer extended deterrence to allies. This extended deterrence has recently taken a slide since the Gulf War. Saddam Hussein showed the world that the threat of conventional deterrence carries little weight in influencing the decisions of the world's henchmen. Most modern countries have learned that the United States will not risk nuclear war in this day and age unless the United States is itself is threatened. In light of this, the time has come for the United States to take a stand and maintain a force structure that will enable it to not only fight 2 MRCs, but to also present a credible conventional deterrent while maintaining a credible nuclear deterrent. Finally, it must be able to project military power world wide. Military forces must be able to respond anywhere in the world, at a moments notice to prevent the world's bad guys from being able to mount a swift offensive thrust where a country could be taken over easily.

While it is necessary to draw down military forces in the face of a rising national debt, the way in which we draw down becomes vitally important. One must be able to present a credible deterrent while drawing down, and in today's world where time is everything, long range bombers must be maintained in sufficient quantity to project force at a moment's notice.

Why Nothing Else Can Substitute for the Long Range Bomber

In the specific instance of attempting to slow or halt an enemy invasion force, only a robust long range bomber force can answer the mail. It is arguably, the only weapon system capable of delaying, disrupting, or destroying a front line invasion force in the first few days of the invasion. The reasons for this are the inherent capabilities long range bombers offer, namely, the ability to quickly strike an enemy on the move, from within the continental United States. The problem with trying to use sea and land assets is that they are no longer pre-positioned throughout the world to be able to answer the call to halt an enemy invasion in the short amount of time necessary to keep an ally from being overrun. Cruise missiles appear to be the salvation of a war effort, offering a cheap way, in terms of cost in both blood and treasure, however, they fall short when the task is trying to halt an invasion force on the move. If the invasion force is static, cruise missiles offer another way of killing the enemy. When the enemy is mobile however, the present day cruise missiles do not have the capability to be re-targeted once they have left their launch vehicle. Take for instance the case where a cruise missile requiring 15 minutes of flight time, is targeted prior to launch against a moving armored infantry. If this infantry unit is moving at the modest rate of only 4 miles per hour[31], by the time the missile gets to the target, the unit will have moved 1 mile, causing the missile to miss its ob-

jective. While this can be compensated for to a degree, by saturating a projected area with cruise missiles, this is still uncertain, and it has now lost its benefit of cost effectiveness. Add to this the fact that a cruise missile is actually a small aircraft that is carrying a small bomb, both of which are unusable, and the cost effectiveness issue becomes more muddled.

While aircraft carriers offer an abundance of firepower and offensive capability, the fact of the matter remains, that ships travel slowly. In the case of a surprise invasion where the invasion force is moving rapidly against an ally's capital of Strategic Center of Gravity, this floating armada may not get there in time to halt the invasion before the enemy achieves his objectives.

How the B-2 Could Help Halt or Slow a North Korean Invasion

Should North Korea decide to invade South Korea, there is a chance that both South Korea and the United States will be caught off guard. Our historical track record is less than perfect when it comes to predicting invasions. Pearl Harbor in 1941, Korea in 1950, and Kuwait in 1990 were not anomalies---similar failures in gauging the intentions of potential aggressors and responding to strategic warning are likely to be the rule, not the exception, as the United States enters this new era of uncertainty and instability. This heightens the importance of speed of response.32

In these instances, one could legitimately surmise that the United States was ill prepared for the invasions that occurred. In the latter case of Kuwait, due to the element of surprise, the US required a lengthy build up and deployment time. This is a luxury that we must not assume a future adversary will afford us. It is therefore imperative that

the United States maintain the capability to blunt an invasion force immediately[33]. This is especially true on the Korean peninsula due to the readiness of North Korea's military on the peninsula, and the close proximity of the DMZ to Seoul.

There would be many ways in which one could play out a possible invasion scenario on the Korean peninsula. As previously mentioned however, history may offer some help in this area. Many believe that should North Korea invade the ROK again, that it will occur quickly and with the same type of speed that was used in the 1950's. North Korean doctrine attempts to capitalize on the Russian tenets of ***speed, shock,*** and ***surprise***.[34] This is how they began their invasion in 1950, and there is little evidence to lead one to believe that they would not use the same doctrine should they decide to invade the ROK again. For analysis purposes, this doctrine offers the worst case scenario where the United States is caught by surprise (as in the case of the Iraqi invasion of Kuwait) and has to react without the luxury of a build-up period where hostilities are curbed. The Iraq invasion of Kuwait may have employed all three elements of speed, shock, and surprise when they initially invaded Kuwait however, they soon gave up the elements of speed and surprise when they dug in and failed to advance further. This "digging in" afforded the United States and the coalition a luxury of being able to take the time to build-up forces in theater prior to a counter-attack. Also, the desert terrain made "dug-in" armored vehicles ideal targets for the coalition air, naval, and ground forces. The North Koreans on the other hand, have already demonstrated that they use rapid rates of advancement to enhance the shock effect through the speed of the invasion. In 1950 for example, they were able to take South Korea's capital, Seoul in just three days.[35] They maintain mobility in their armored divisions and still rely on rapidly moving forward and

pressing the attack deep into the defender's territory. As in the 1950 invasion, there is no reason to believe that they would not utilize their robust Special Forces to conduct activities in the ROK's rear areas. This makes an immediate response by the ROK forces and the United States vital to prevent the North Korean forces from enjoying early successes that will enable them to entrench themselves in South Korean territory.

This 1950 Korean scenario offers other unique characteristics that will be especially useful in determining whether the B-2 is either required or desired to help blunt the invasion forces. Among the more interesting characteristics is the multi-pronged assault by the North Koreans; the rapid, blitzkrieg type attacks resulting in almost pushing the United Nations off the peninsula at the start of the conflict; the rapid advance through Seoul, South Korea's capital; and the denial of some airfields and bases to United Nation's forces. Combined with the increase in naturally hardened sanctuaries, extensive tunneling, and extremely difficult terrain in terms of the mountains and foliage, the Korean peninsula requires rapid, almost immediate response with the right mix of weapon systems. One must bear in mind that this is a very different scenario than the Gulf War where we were fighting in a desert environment with weapon systems suited to seeking out targets in an open environment and destroying them. In a Korean scenario, one can neither count on the targets being out in the open, or in a fixed position. When not on the move, the North Korean forces will most likely be either camouflaged, or hidden in natural concealment.

In an effort to play out a scenario, we must again refresh our memories on the historical events, as well as update forces and some weaponry. The bottom line is that we are interested in how many armored vehicles a weapon system must kill before the inva-

sion can be halted or at least slowed.[36] In this scenario, the time it takes to kill a given number of the enemy's armored vehicles will be used as the basis for comparison. The reason that this analysis uses a kill rate, or rate of attrition, is due to the inaccuracy of rate of advance modeling. According to Dr. Stephen Biddle from the Institute for Defense Analysis, advance rate modeling is the least accurate of anything the military does. According to Dr. Biddle, the reason for this is that an enemy's rate of advance is the most psychologically driven factor in modeling.[37] With this in mind, this study will look at the length of time it will take to destroy both 3,500 and 5,000 North Korean armored vehicles.[38]

In 1950, when the North Koreans began their march across the South Korean border, they mounted four main thrusts. The invasion began with a combined arms North Korean quadruple assault. The main thrust came through the Uijongbu Corridor with two NKPA divisions attacking the ROK 7th Division.[39] Following Soviet Doctrine, this was a fast moving, armor spearhead that overwhelmed the ROK forces quickly and decisively. Simultaneously, there were other armored NKPA spearheads that consisted of: two divisions attacked the ROK 6th Division on the eastern side of the Korean peninsula (in the hilly region); NKPA forces attacked the ROK 17th Regiment on the Ongjin peninsula destroying one battalion and forcing the rest to evacuate; and on the mountainous east coast, NKPA forces forced the ROK 8th Division to withdraw after they mounted a successful frontal assault in conjunction with an amphibious assault that enveloped the ROK forces.[40] Following Soviet Combined Arms Doctrine, the NKPA utilized it's Air Forces to enhance the speed and mobility of the invading ground forces. Although the NKPA Air Force was small, and quickly dominated by the Far Eastern Air Forces

(FEAF,) they were a factor in the beginning stages of the invasion. The NKPA's invasion force was further aided by the numerous "time bomb" agents that had been "planted" in South Korea to be activated in time of war.[41] These agents, along with a robust Special Forces, helped pave the way for a rapid overrun of ROK forces.

The underlying question now becomes whether or not one can believe that the North Korean Doctrine is still basically the same as it was in 1950. If this is true, then one can reasonably conclude that there is a strong possibility that the North Koreans would employ their military forces in a manner similar to 1950. General Robert W. RisCassi, USA, Commander In Chief, U.S. Forces, Korea believes that the North Korean force is still very much geared to offensive operations. He states:

> *The core philosophy guiding the north's program appears to have been the transformation of its armed forces into a highly mobile, extremely lethal, offensive force. The ultimate objective was to create a ground-based attack force, supported by air, special operations and sea arms, capable of unleashing a rapidly paced offensive operation on extremely short notice. Its armed forces were designed to create an early rupture of the combined defenses and follow up on this breakthrough with powerful exploitation forces.*[42]

General RisCassi goes on to state that: "The approximately 80,000 special operations forces are designed to infiltrate behind ROK defenses, to target airfields, seaports and supply lines, and to disrupt and undermine forward defenses to assist in achieving an early breakthrough."[43] Reasonably, one could determine that there is a likelihood that airfields and bases in South Korea will not be available to the United States or United Nations Forces once the invasion is mounted. This will necessitate operations off the peninsula and therefore require aircraft with greater range capabilities to "carry the fight" to the enemy.

For the purposes of this analysis, it is given that all aircraft are able to "kill" armored vehicles at the same rate.[44] At the same time, this study will assume that there are no bases on the Korean peninsula from which to conduct friendly air operations. The underlying assumption is that the NKPA Special Operations Forces (SOF) have infiltrated and negated all remaining airfields in South Korea.[45] With this in mind, the question now becomes how long will it take each weapon system to "kill" 5,000 NKPA armored vehicles. In an effort to "kill" 5,000 NKPA armored vehicles, each of ten NKPA armored divisions will be taken down by 350 armored vehicles. The impetus for this is from a RAND study that concluded a division could be stopped from advancing when it lost 350 armored vehicles.[46] Throughout this simple analysis, there is no attempt to deny the importance of achieving air superiority. There are however, certain strategic and tactical advantages to modern, stealthy weapon systems. One of those advantages is the capability to operate in a hostile environment with a certain degree of impunity. In the context of an invasion scenario where enemy forces are invading friendly territory, this study assumes that stealth aircraft have the ability to operate freely over the battlefield.[47] It also assumes that all aircraft compared will be carrying a 2,000 pound variation JDAM (Joint Direct Attack Munitions,)[48] an all weather precision munition with an accuracy of 3 meters or less.[49]

Halting The Invasion

The likelihood of a surprise invasion is realized in a statement to the House Armed Services Committee by General RisCassi. He states that "Unlike Operation Desert Storm, where coalition forces had six months to organize and train, a North Korean

attack would provide at most several days of warning and preparation."[50] With this in mind, should North Korea invade South Korea, it is assumed for the purpose of this analysis, that it occurs with no warning. This is a worst case scenario that allows no time to preposition additional equipment and supplies, and tasks the U.S. lift capability. Using the 1950 guidelines with increased force strengths for the invasion, this analysis has 12 Korean divisions attacking ROK forces consisting of 6 divisions (a 2:1 advantage). Once again, it is a four pronged attack with 3 divisions each attacking up the Uijongbu corridor; along the east; in the western mountains and from the south advancing north. Upon learning of the invasion, the United States is faced with a decision as to what move to make first. The decision is made to attempt to halt the invasion while rapidly deploying forces to the theater. In the case of a Carrier Battle Group (CVBG) attempting to halt the invasion force by itself, one must first determine what the CVBG brings to the fight. As far as bomb dropping aircraft are concerned, the CVBG used for the purposes of this comparison is comprised of 20 F/A-18E/F and 20 A/F-X airframes[51] with a capability of dropping 2 bombs each.[52] At a rate of 1.1 sorties per airframe per day[53] with a 100% kill rate, it would take this force 39.8 days to kill 3,500 armored vehicles, and 56.8 days to kill 5,000 armored vehicles assuring the invasion force was stopped. This assumes that the CVBG is "on station" when the hostilities break out and doesn't take into account the time it would take for the CVBG to travel from another area to the theater. Using an equivalent[54] number of 168 F-117s carrying the same 2 bomb per airframe load, with a rate of 1 sortie per airframe per day[55], one sees that it takes 10.42 days to kill 3,500 armored vehicles, and 14.88 days to kill 5,000 armored vehicles. Again, this does not count the time necessary to shuttle aircraft and munitions

closer to the theater and within the range of the F-117. Finally, using an equivalent force of 43 B-2s carrying a load of 16 bombs each, and a rate of 1 sortie per airframe per day[56], it takes the B-2 force 5.1 days to kill 3,500 armored vehicles, and 7.26 days to kill 5,000 armored vehicles.

Number of Days to Kill 3,500 & 5,000 Armored Vehicles (100% effectiveness)

Air Power	# Bombs per a/c	# Sorties per day per a/c	# of aircraft	Total Bombs Delivered per day	Days to Kill 3,500 Armored Vehicles	Days to Kill 5,000 Armored Vehicles
CVBG	2	1.1	40	88	39.8	56.8
F-117	2	1	168	336	10.42	14.88
B-2	16	1	43	688	5.1	7.26

Table 10

Table 10 and Chart 10 show the number of days it takes each weapon system to be able to destroy 10 armored divisions (3,500 armored vehicles) and completely halt the invasion by destroying 5,000 armored vehicles based on a 100% weapon effectiveness. Tables 11, 12, and 13, and Charts 11, 12, and 13 show the same data with only 85%, 75%, and 50% weapons effectiveness respectively.

Number of Days to Kill 3,500 & 5,000 Armored Vehicles (85% effectiveness)

Air Power	# Bombs per a/c	# of aircraft	# Sorties per day per a/c	Total Bombs Delivered per day	Days to Kill 3,500	Days to Kill 5,000
CVBG	**2**	**40**	**1.1**	**74.8**	**46.8**	**66.8**
F-117	**2**	**168**	**1**	**285.6**	**12.55**	**17.51**
B-2	**16**	**43**	**1**	**584.8**	**5.98**	**8.55**

Table 11

Number of Days to Kill 3,500 & 5,000 Armored Vehicles (75% effectiveness)

Air Power	*# Bombs per a/c*	*# of air-craft*	*# Sorties per day per a/c*	*Total Bombs Delivered per day*	*Days to Kill 3,500*	*Days to Kill 5,000*
CVBG	**2**	**40**	**1.1**	**66**	**53**	**73.8**
F-117	**2**	**168**	**1**	**252**	**13.89**	**19.84**
B-2	**16**	**43**	**1**	**516**	**6.78**	**9.69**

Table 12

Number of Days to Kill 3,500 & 5,000 Armored Vehicles (50% effectiveness)

Air Power	**# Bombs per a/c**	**# of air-craft**	**# Sorties per day per a/c**	**Total Bombs Delivered per day**	**Days to Kill 3,500**	**Days to Kill 5,000**
CVBG	**2**	**40**	**1.1**	**44**	**79.5**	**113.6**
F-117	**2**	**168**	**2**	**168**	**20.83**	**29.76**
B-2	**16**	**43**	**1**	**344**	**10.17**	**14.53**

Table 13

Although build-up time was not considered in this analysis, it should be noted that the B-2 is the only weapon system compared that does not require a build-up time. Currently, it is the only aircraft capable of operating from within the Continental United States (CONUS). For this reason, this analysis assumes that the B-2s will launch their first sortie from the CONUS and recover to Guam while still being within striking range of the Korean peninsula.[57]

Chart 10

Number of Days Required to Kill 3,500 and 5,000 Armored Vehicles (100% effectiveness)

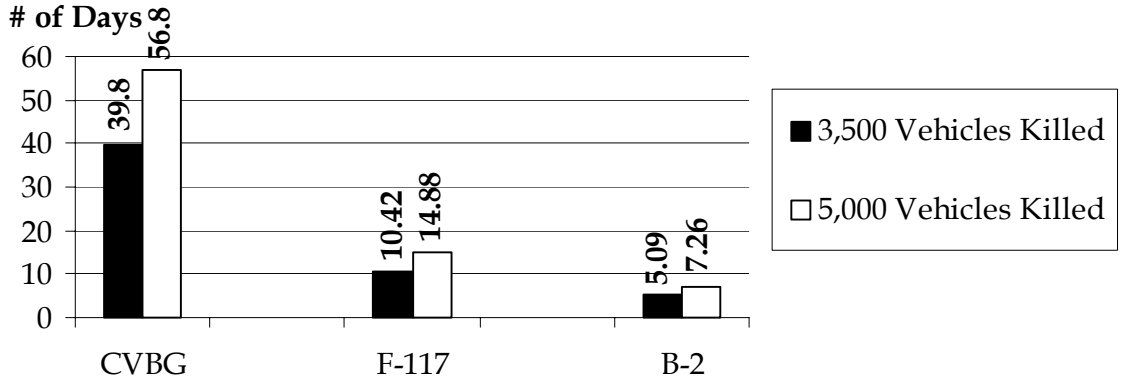
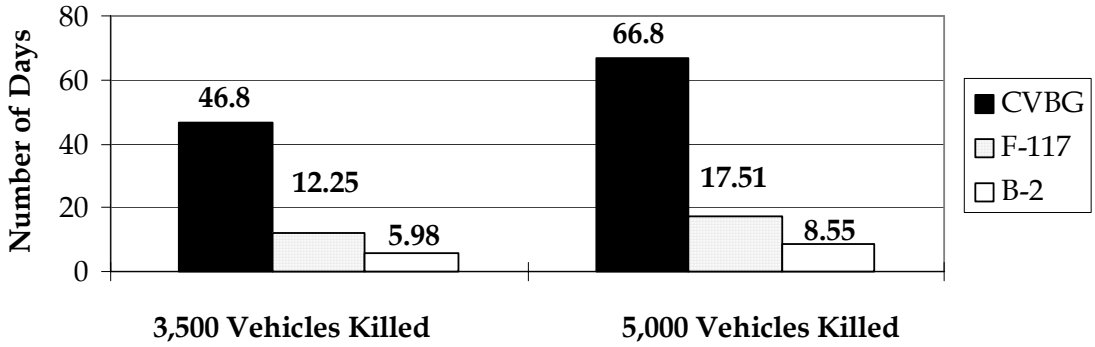
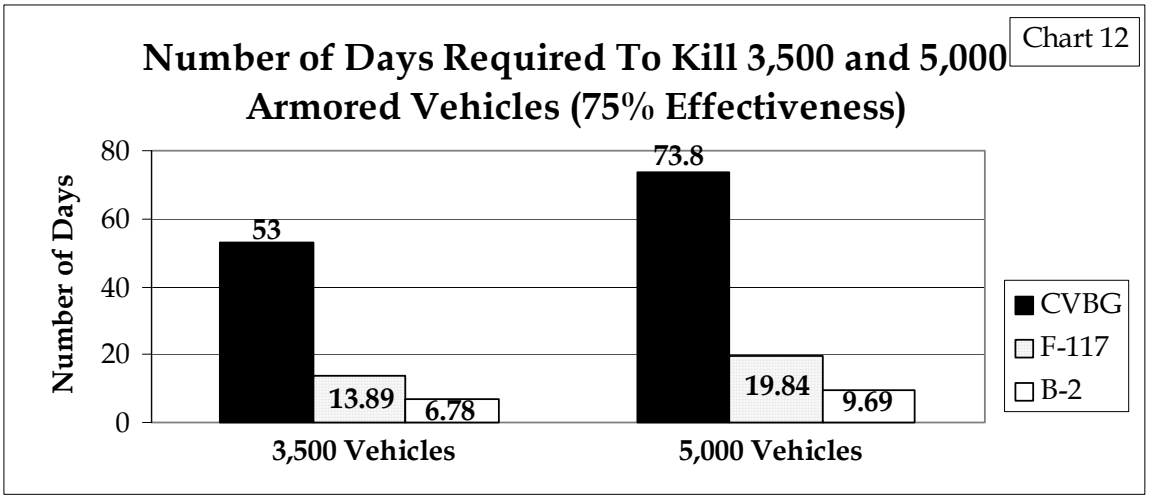
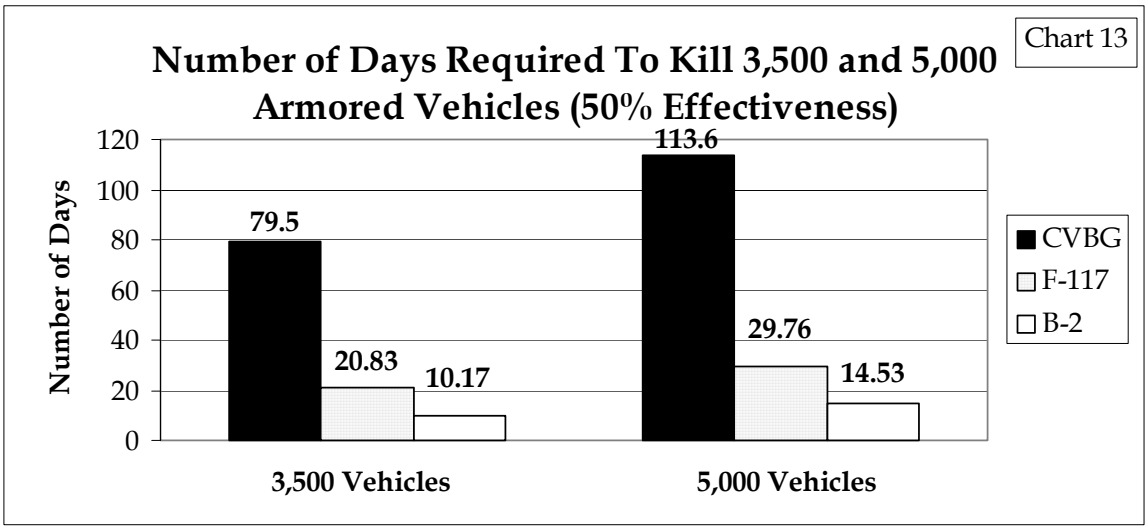


Chart 11

Number of Days Required To Kill 3,500 and 5,000 Armored Vehicles (85% Effectiveness)







[31] The average rate of advance for a mechanized division is between 30 to 80 Kilometers per day.

[32] Christopher Bowie et al., *The New Calculus* (Santa Monica, CA.: RAND, 1993), pp. 6-7.

[33] Based on the Korean War in 1950, where Seoul was overrun in 3 days due to its proximity to the DMZ, I use the Term immediately to make the point that the United States must be capable of blunting an invasion force prior to 3 days. While this is a lofty goal, it is not insurmountable. One must bear in mind however, that not all prongs of an invasion force need be stopped within 3 days. If, for example, the 1950 Korean invasion were replayed, then to keep the NKPA from overrunning Seoul, only those forces attacking Seoul need be halted within the 3 days. In the case of 1950, one would have had to destroy the two NKPA divisions attacking through the Uijongbu corridor.

[34] The way Communist North Korean Doctrine mirrors the former Soviet Union Doctrine is logical in light of the fact that it was Soviet advisors who trained North Korean soldiers in Soviet equipment in the 1940's. The Soviet influence lasted for almost one half a century until the break-up of the former Soviet Union into the Commonwealth of Independent States. Until this time, the former Soviet Union continued to provide equipment to Communist countries including North Korea.

[35] Matthew B. Ridgway, *The Korean War* (New York, NY: Doubleday, 1967), p 253.

[36] One must keep in mind that a given weapon system is capable of killing x armored vehicles. The measure of effectiveness here is in how armored vehicles the B-2 can kill compared to the F-117, or a Carrier Battle Group. As long as the types of vehicles remains constant for all weapon systems, the measure should remain valid.

[37] Stephen Biddle, *The Determinant of Offensiveness and Defensiveness in Conventional Land Warfare* (Ph.D. dissertation, Harvard University, 1992), 54.

[38] According to RAND, once 5,000 enemy armored vehicles are destroyed, the enemy invasion force will grind to a halt. Their estimates were based on running a Southwest Asian scenario and a Korean scenario. For further information and detail, see Christopher Bowie et al., *The New Calculus,* RAND, 1993. RAND also estimates that it requires 350 enemy armored vehicles to be destroyed per division to render that division ineffective (in other words, halt that division.) The calculation is based on an Iraqi armored division containing 750 armored vehicles. RAND's study concluded that once 350 of these armored vehicles were destroyed, the division was halted and was unlikely to be reconstituted. Details are contained in: Glenn Buchan, Dave Frelinger, and Tom Herbert, *Use of Long-Range Bombers to Counter Armored Invasions* (Santa Monica, CA.: RAND Corporation, March, 1992).

[39] Clay Blair, *The Forgotten War: America in Korea* (New York, NY: Doubleday, 1988), 60.

[40] Ibid.

[41] Current estimates are that NKPA "time bomb" agents still are used and are presently in South Korea. The logic would be that these agents would aid and invasion force by helping to destroy airfields, bases, etc.

[42] Prepared statement of General Robert W. RisCassi, USA, Commander In Chief, U.S. Forces, Korea in House, *Regional Threats And Defense Options For The 1990s: Hearings before the Defense Policy Panel and the Department of Energy Defense Nuclear Facilities Panel of the Committee on Armed Services,* 102d Cong., 2d sess., 1992, p. 241.

[43] Ibid.

[44] Although arguments can be made that one aircraft is more capable than the others in terms of being able to "kill" enemy armored vehicles, this is beyond the scope of this paper. All weapon systems depicted are leading edge technology and the two largest differentiators may well be the speed advantage of the F/A-18 and A/F-X over the B-2 and the F-117; and the comparatively low RCS (radar cross section) of the B-2 and the F-117 versus the F/A-18 and the A/F-X. The assumption is made that all aircraft can carry the same types of weapons and for the sake of this analysis, like weapons are used for each aircraft. If the B-2 is carrying SFWs (Sensor Fused Weapons), then all other aircraft will carry the same SFW with the same capabilities, advantages, and disadvantages of the weapon.

[45] While it may be argued that this is "unrealistic," in the light of forward basing draw-downs and future budget constraints, in the opinion of this author, it is none the less a "worst-case" scenario that must be considered. Further, this takes away the hidden costs of forward basing and helps "level the playing field" for each weapon system.

[46] Glenn Buchan, Dave Frelinger, and Tom Herbert, *Use of Long-Range Bombers to Counter Armored Invasions* (Santa Monica, CA.: RAND Corporation, March, 1992), 4.

[47] This is not to say that attacks could be made in hostile enemy territory without risk, but simply that modern stealth aircraft are assumed to have air superiority by the virtue of their stealthiness. In other words, you can't kill what you can't see. While this may seem brash, according to numerous accounts, the F-117s had little problem operating over Iraq from the very start of the war, through the very end.

[48] JDAM is designed to utilize the Global Positioning System (GPS) capability of the B-2. This weapon would be able to accept updates from the B-2's GPS allowing each of the 16 JDAMs carried per B-2 to attack an independent target with this type of accuracy.

[49] David A. Fulghum and William B. Scott, *Sensor Package Could Allow B-2 Bomber To Find, Attack Targets Independently,* Aviation Week & Space Technology, March 16, 1992, 19.

[50] Prepared statement of General Robert W. RisCassi, USA, Commander In Chief, U.S. Forces, Korea in House, *Regional Threats And Defense Options For The 1990s: Hearings before the Defense Policy Panel and the Department of Energy Defense Nuclear Facilities Panel of the Committee on Armed Services,* 102d Cong., 2d sess., 1992, p. 243.

[51] The estimate of 20 A/F-X and 20 F/A-18E/F aircraft per carrier comes from the Congressional Budget Office Staff Memorandum entitled *Using B-2 Bombers For Conventional Naval Missions,* (Washington D.C.: Congressional Budget Office, September 1991) 8.

[52] These estimates come from the assumption that the F/A-18s and the A/F-X will carry the same 2,000 lb. bomb load as the F-117. This equates to 2 bombs per airframe based on carrying a 2000 pound Inertially Guided Weapon

(IGW) munition such as JDAM (Joint Direct Attack Munitions.) JDAM is projected to have a precision all weather capability with INS/GPS guidance. This is the same type of munition that all aircraft compared will be assumed to carry. Even if one were to attempt to lower the weapon class in an effort to allow the F-117 to carry more fire power for example, the bottom line is that the F-117 can only carry 2 (two) 2,000 lb. bombs, and only 2 (two) 500 lb. bombs. Therefore, no advantage is given to the F-117 by lowering the weapon class. In fact, it would skew the data further in favor of the B-2.

[53] According to a study accomplished by LtCol Roy Mattson in May 1992 *Projecting American Air Power: Should We Buy Bombers, Carriers, or Fighters?*, he used an estimate of a total of 45 sorties per day per carrier. These figures are based on Desert Storm Operations and are detailed in a pamphlet by the Department of the Navy, Office of the Chief of Naval Operations, *The United States Navy in "Desert Shield" "Desert Storm"* (Washington D.C.: Office of the Chief of Naval Operations, 15 May, 1991).

[54] I use the term "equivalent" to denote the amount of forces that can be acquired and operated for 20 years with an equivalent amount of money that it costs to acquire and operate a CVBG for 20 years. In this analysis, for the same amount of money that it costs to acquire and operate one (1) CVBG, one can acquire and operate a force of 168 F-117s or 43 B-2s for 20 years. I purposely omit the support aircraft and home ports as well as CONUS bases required by the CVBG. If anything, this would help to keep the CVBG costs artificially low.

[55] While the F-117 attained the relatively low sortie rates in the Gulf War of .65 to 1.2 sorties per day (see Mattson, *Projecting American Air Power,*) I use a sortie rate of 1.0 under the assumption that the F-117 will only improve its sortie rate with time while incorporating lessons learned in the Gulf, and will at least approach that of carrier air. The reason I do not go over 1.0 sortie per day is due to the nature and environment that stealth aircraft operate in. This eliminates daylight sorties (except under the cover of clouds) and would inhibit a greater sortie production rate.

[56] This sortie rate is dependent on shorter sortie durations made possible by forward basing the B-2 force after the first mission from within the CONUS. This rate would be based on the B-2 flying only at night or under the cover of weather (as would the F-117) with approximately the same sortie durations as the F-117.

[57] Although one could make an argument that the cost of forward bases should be included in the cost of the B-2 (or the F-117) I chose not to due to the fact that a CVBG can not sustain itself indefinately. For this reason, it must utilize a home port and must also utilize supply depots (as the B-2 or F-117 forces would at a forward base) to replenish weapons and supplies. If one takes into account the amount of support infrastructure required on land to keep a CVBG afloat, the cost of the CVBG would be significantly higher.

Chapter 5

Conclusion and Recommendations

As we get closer to a new century and a new chapter in the history of the United States Military Forces, the United States must continue to demand that it maintain a "quality force" second to none. This concept of "quality force" is not limited to personnel, but it also encompasses everything the military possesses. This includes every weapon system in the Department of Defense inventory. What we must insist upon in times of tight budgets and increasing fiscal constraints, are weapon systems that deliver the most "bang for the buck." We must endeavor to keep service biases off to the side in our quest for what is the right weapon system to protect the interests of the United States now, and in the years to come. Indeed, in these times of draw-downs, there will be those that persist only in the name of saving their job, but those will be few.

This simple analysis has shown the benefits of a stealthy, long-range bomber like the B-2. As America moves forward into the Twenty-First Century, it is apparent that we will become more disengaged from the rest of the world, and turn our attention and money towards home. This is a noble and worthwhile cause and this study is in no way meant to indicate that our course should be altered.

What it is meant to provide, is a basis for acquiring and employing long-range bombers. The B-2 for example, is the most cost effective weapon system of all those compared and is the only weapon system capable of holding virtually all targets at risk

from within the Continental United States. For the price of acquiring a single Carrier Battle Group, we could buy another 26 B-2s. This would ensure the United States has the power necessary to immediately respond and stop an invasion force cold, anywhere in the world. Of course, hopefully the deterrent effect of possessing such a force would serve to help calm the world and protect United States interests both domestic and foreign.

This analysis has also shown why long-range is becoming increasingly important. With the void left by the Former Soviet Union (FSU), while the risk of all out total nuclear war has been reduced, there is an increased risk of smaller-scale conflicts. As we turn inward and attend to our domestic problems, we leave behind an uncertain world. A world that is continuing to evolve as more and more nations compete to fill the void left by the FSU. Long-range bombers are the most cost effective way of providing not only a deterrent effect, but the capability to respond immediately to a crisis anywhere in the world, without the extensive support required by other weapon systems. This is not meant to say that the only force that is necessary for the United States to possess is a hardy B-2 force, but rather it is meant to show the need for this integral part of modern air power in terms of present day and future conflict scenarios. More and more it appears that the United States picks its fights and only engages an enemy if US interests are threatened. As the capability of potential aggressors to put those interests at risk grows, and as we draw-down both our foreign presence and our domestic forces, it becomes more and more vital for the US to be able to halt an aggressor immediately. With some forethought, and the right mix of weapon systems, the US will continue to maintain that ability well into the Twenty First Century and beyond.

In closing, it must be stressed once again, that the B-2, nor the F-117 is the sole answer to our problems. They must carry the right mix of munitions like JDAM and BAT. They must be used wisely, and in concert with our US Army, Navy, and Marine brethren. They are but one tool in our arsenal and like all tools, have a specific purpose or purposes. This analysis profiled halting an invasion force for good reason--halting an invasion force is where long-range is needed the most due to its immediacy of effect. Once the US Navy arrives on station, some of their air assets should be used to attack the invasion force, as well as any short-range tactical air power that arrives in theater. This will help allow some of the long-range and stealth aircraft (the B-2 and F-117) to shift their efforts towards deep interdiction type missions against strategic targets if required.

Also, once the advantage was sufficiently in favor of our ground forces and amphibious forces, they should be employed in the best manner to bring about as quick and decisive a victory as possible. In essence, they should also be utilized as "tools" for their specialized tasks. The importance of bringing all the "tools" into the fight can not be overlooked. Just as one would not try to turn a screw with a hammer, or build a house without ***all*** the necessary tools, one should not try to halt an invasion force without ***all*** the ***right*** tools. Although this paper makes a case for more B-2's than are currently planned for, or at least, keeping the production lines open so that more may be rapidly produced should war become an eventuality, it is not meant to suggest that the B-2 is the "only game in town." Far from this, the realization that the B-2 has its place in the overall strategy of the USAF and the DOD, and that this role relies on the ability of other weapons systems to do their jobs, is ever present. The fact is that the B-2, nor any other weapon system, is capable of winning ***every*** potential conflict that may arise in the future

on its own. While the B-2 may in fact be the weapon system of choice for immediately responding to a crisis, or halting an invasion force, it has its limitations. This analysis supports the idea that changing technology has increased air power's ability to contribute to modern warfare. To continue to be effective in the use and employment of our military's air arm, we must demand the best weapon systems possible within budgetary constraints. We must also realize that freedom has not ever, and will not ever come cheaply. In the words of General Colin Powell:

> *We cannot lead without our armed forces. Economic power is essential; political and diplomatic skills are needed; the power of our beliefs and our values is fundamental to any success we might achieve; but the presence of our arms to buttress these other elements of our power is as critical to us as the freedom we so adore. Our arms must be second to none.*
> General Colin Powell, former Chairman Joint Chiefs of Staff[58]

[58] Colin L. Powell, "U.S. Forces: Challenges Ahead," *Foreign Affairs,* Winter 1992/93, 33.

Selected Bibliography

1992 Joint Military Net Assessment, Unclassified version, The Directorate for Force Structure, Resources, and Assessment, 21 Aug 92

Biddle, Stephen. *The Determinant of Offensiveness and Defensiveness in Conventional Land Warfare*. Ph.D. dissertation, Harvard University, 1992.

Blair, Clay. *The Forgotten War: America in Korea.* New York, NY: Doubleday, 1988.

Bowie, Christopher et al. *The New Calculus*. Santa Monica, CA.: RAND, 1993.
to Counter Armored Invasions. Santa Monica, CA.: RAND Corporation, March, 1992.

Bush, George, *National Security Strategy of the United States*. The White House, January 1993.

Congressional Budget Office. "Options For Fighter and Attack Aircraft: Costs and Capabilities." *CBO Staff Memorandum,* Washington, D.C. May 1993.

Congressional Budget Office. "The Long-Term Costs of Naval Forces Options." *CBO Staff Memorandum,* Washington, D.C. May 1993.

Congressional Budget Office. "Using B-2 Bombers For Conventional Naval Missions." *CBO Staff Memorandum*, Washington, D.C. September 1991.

Diamond, John. "Senators Suggest Arming S. Korea," *Montgomery Advertiser*, 24 February 1994.

Easterbrook, Gregg. "Sticker Shock: The Stealth Is a Bomb" *Newsweek*, 23 January 1989.

Fulghum, David A. "Air Force To Improve Submunitions' Accuracy." *Aviation Week & Space Technology*, 4 April 1994.

Fulghum, David A. and Scott, William B. "Sensor Package Could Allow B-2 Bomber To Find, Attack Targets Independently." *Aviation Week & Space Technology*, 16 March 1992.

Fulghum, David A. "Smart Weapons To Boost Impact of B-1, B-2 Force." *Aviation Week & Space Technology*, 2 May 1994.

Fulghum, David A. "Study Details New Conventional Role for B-2 Stealth Bomber. *Aviation Week & Space Technology*, 8 June 1992.

Hastings, Max. *The Korean War.* New York, Touchstone, 1988.

House. "Procurement of Aircraft, Missiles, Weapons and Tracked Combat Vehicles, Ammunition, and Other Procurement." *Hearings before the Procurement and Military Nuclear Systems Subcommittee of the Committee on Armed Services,* 102d Cong., 2d sess., 1992.

House. "Regional Threats And Defense Options For The 1990s." *Hearings before the Defense Policy Panel and the Department of Energy Defense Nuclear Facilities Panel of the Committee on Armed Services,* 102d Cong., 2d sess., 1992.

Hughes, David. "Extensive Simulation Guides BAT Design*," Aviation Week & Space Technology*, 11 October 1993.

Mattson, LtCol Roy. *Projecting American Air Power: Should We Buy Bombers, Carriers, or Fighters*. School of Advanced Airpower Studies Thesis, May 1992.

Northrop Corporation. *B-2 Stealth Bomber 1992 Fact Book.* September 1992.

Northrop Corporation. *B-2 Stealth Bomber 1994 Fact Book (Draft).* 3 November 1993.

Powell, Colin L. "U.S. Forces: Challenges Ahead," *Foreign Affairs,* Winter 1992/93.

Ridgway, Matthew B. *The Korean War*. New York, NY: Doubleday, 1967.

RisCassi, General Robert W. USA, Commander In Chief, U.S. Forces, Korea. Prepared statement in House, *Regional Threats And Defense Options For The 1990s: Hearings before the Defense Policy Panel and the Department of Energy Defense Nuclear Facilities Panel of the Committee on Armed Services*, 102d Cong., 2d sess., 1992.

Senate. "Operation Desert Shield/Desert Storm." *Hearings Before the Committee on Armed Services, United States Senate*, 102d Cong., 1st sess., 1991.